

Mesoscopic Quantum Measurements

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Recent efforts at development of mesoscopic solid-state qubits for quantum information processing motivate interest to the problem of quantum measurement with mesoscopic detectors. Conceptually, this problem is interesting since the measured systems, qubits, and typical detectors are of the same "mesoscopic" dimensions, the fact that creates a new perspective on the old problem of the wave function reduction. In the lectures, after giving several examples of both mesoscopic qubits and detectors, I will introduce quantitative approaches to the description of dynamics of the quantum measurement process. The topics that will receive particular attention include linear quantum measurements and quantum-limited detectors, non-demolition qubit measurements, quadratic measurements and error-correction in Josephson-junction qubits, and relation between counting statistics and detector properties of quantum point contacts.